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Empirical Evidence from Canadian Firm-level Data on the Relationship Between Trade and Productivity Performance

by John R. Baldwin and Beiling Yan

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^{r} revised
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Abstract

Canada's aggregate productivity performance has closely tracked changes in Canada's trading environment. To gain a better understanding of the link, the Economic Analysis Division of Statistics Canada has conducted a set of studies that investigate whether and how changes in the trading environment, brought about by trade liberalization policies and exchange-rate movements, contributed to productivity growth. The firm-level analysis provides insights into the productivity dynamics that arise from within-industry growth and restructuring as resources are shifted from declining to growing industries. The paper provides an overview of the key Canadian empirical findings over the last two decades.

Keywords: trade, productivity, exchange rate, North American Free Trade Agreement (NAFTA)

Executive summary

Canada's aggregate productivity performance has closely tracked changes in Canada's trading environment. The close relationship has been driven by changing industry composition that was stimulated by major changes in the circumstances facing firms, such as changes in the trading environment brought about by trade liberalization policies and exchange-rate movements.

To gain a better understanding of the link, the Economic Analysis Division of Statistics Canada conducted a set of studies that investigated whether and how changes in the trading environment contributed to productivity growth. This paper provides an overview of the key Canadian empirical findings, focusing on studies that analyze the Canadian economy following trade liberalizations in the 1990s and the sharp currency appreciation in the 2000s.

A common theme emerging from the firm-level research is that adapting to new larger markets, whether domestic or foreign, is beneficial to productivity growth. Larger markets raise productivity by allowing firms to exploit economies of scale and/or product specialization, forcing firms to become more efficient in the face of more competitive pressure, and offering firms more incentives and possibilities to innovate and invest. The empirical evidence also suggests learning-by-exporting—learning from foreign buyers that, together, allow exporters to benefit from adopting foreign technologies.

The benefits from access to larger markets are not automatic—plants that succeed are those that invest in advanced technologies, research and development, and training, all of which help to develop the absorptive capacity required for learning about international best practices.

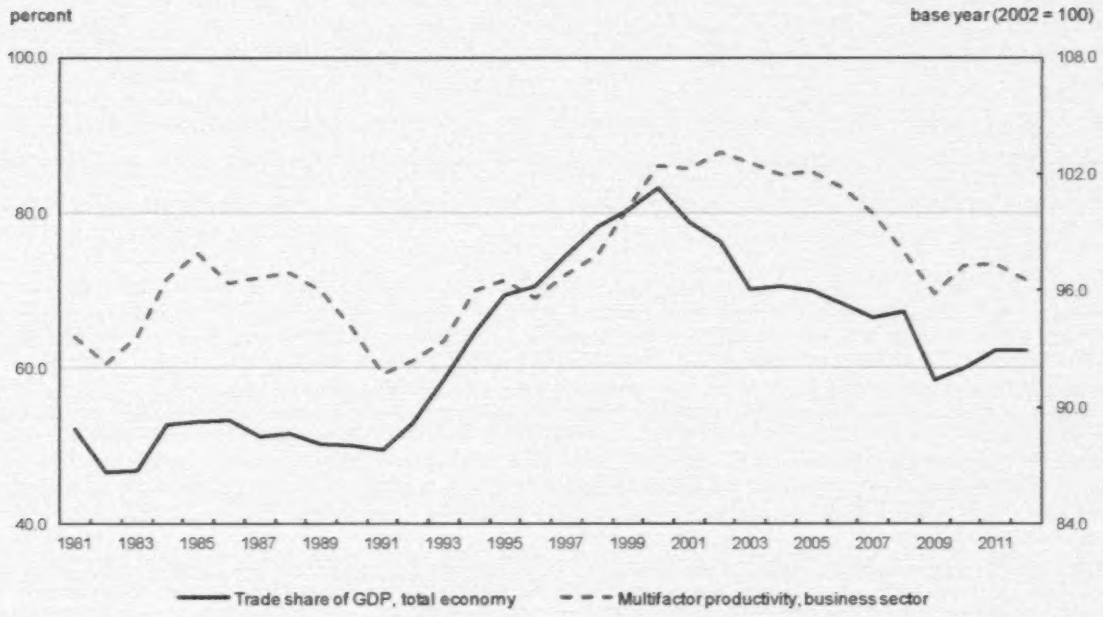
The empirical results show that reallocation of resources from the less efficient to the more efficient firms is another important source of productivity benefits that have arisen from trade liberalization. This is consistent with the predictions of recent trade theories regarding heterogeneous firms: tariff reductions lead the least productive firms to exit and the more productive ones to expand; in this process, economic resources shift from less efficient to more efficient firms, thereby raising aggregate productivity.

The size of these trade-induced productivity gains is, on occasion, attenuated by other changes in international markets, such as exchange rate movements that change the competitiveness of exporters. Recent evidence highlights the challenges faced by the Canadian manufacturing sector, which made heavy investments in the 1990s to serve the new markets in the United States that were opened up by the Canada–United States Free Trade Agreement and the North American Free Trade Agreement, only to face a decline in opportunities in this market a decade later when there was a sharp appreciation of the Canadian dollar against the American dollar.

1 Introduction

Over the past three decades, Canada's aggregate productivity performance has tracked changes in Canada's trading environment surprisingly closely. Multifactor productivity (MFP) growth and the trade share of gross domestic product largely rose and fell together (Chart 1).[1] In the 1990s, when the trade environment became more favourable as a result of the implementation of Canada–United States free trade agreements and the depreciation of the Canadian dollar, Canada's MFP performance improved substantially, growing at an average of 0.7% per year, compared to little or no growth over the 1980s. In contrast, after 2000, the trading environment worsened, due partly to a thickening of the Canada–United States border after 9/11 (Globerman and Storer 2008; Moens and Gabler 2012; Brown forthcoming), and partly to the global resource boom that significantly strengthened the Canadian dollar against the American dollar. In this less-favourable trade environment, Canada's MFP fell at an average annual rate of 0.5%.

Chart 1
Multifactor productivity and trade (nominal share)



Note: Trade share equals exports plus imports relative to gross domestic product (GDP), left axis. Multifactor productivity on right axis, base year 2002 = 100 index.

Sources: Statistics Canada, authors' calculation based on data from CANSIM tables 380-0064, 380-0021 and 176-0064.

This close relationship could be driven by several factors: recent trade theories demonstrate that tariff reductions lead the least productive firms to exit and the more productive ones to expand, resulting in a 'between-firm' reallocation gain in aggregate productivity; and trade may also change the production frontier of an industry, resulting in a 'within-firm' productivity gain due to increased incentives to invest and innovate, increased scale of production, and changes in the organization of firms. The dynamics between and within firms may be stimulated by major changes in the circumstances facing a firm, such as changes in the trading environment brought about by trade liberalization policies and exchange-rate movements. Firm-level analysis provides new insights into productivity dynamics that cannot be gleaned from industry-level data.

1. The correlation between the two series is 0.76.

To gain a better understanding of the link between changes in trading opportunities and aggregate productivity, the Economic Analysis Division of Statistics Canada investigated whether and how changes in the trading environment contributed to productivity growth. Two sets of questions are explored: (1) Do changes in the trading environment impact aggregate productivity? What are the roles of trade liberalization and exchange-rate fluctuations? (2) What are the mechanisms through which changes in the trade environment impact productivity growth? Does increasing access to foreign markets induce changes in firm behaviour, and does industrial restructuring promote aggregate productivity growth? Findings are reviewed in Section 1 for the first set of questions and in Section 2 for the second set of questions.

The empirical evidence reviewed in this paper focuses on studies that analyze the Canadian economy following trade liberalizations in the 1990s and the sharp currency appreciation in the 2000s. The Canadian experience provides a unique opportunity to examine how plants in a domestic market of limited size and in a resource-based economy respond to changes in its trading environment brought about by trade liberalization and currency fluctuations. The studies reviewed in this paper use micro data bases developed for research purposes in the Economic Analysis Division from sources such as the Annual Survey of Manufactures, the 1993 Survey of Innovation and Advanced Technology, and the Workplace and Employee Survey. Taken together, they provide a rich picture of the heterogeneity and dynamics within the Canadian business sector.

2 The trading environment and aggregate productivity growth[2]

Accessing foreign markets generates substantial productivity gains in Canadian manufacturing (Baldwin and Gu 2003; Baldwin and Yan 2014; Gu and Yan 2014). Baldwin and Gu (2003) examine whether exporting increases the productivity of Canadian manufacturers. The evidence is consistent with the view that the more productive plants self-select into export markets and that export participation is associated with better productivity performance (Table 1). Using a multivariate regression analysis that also controls for differences in firm competencies, Baldwin and Gu (2003) found that entrants to export markets between 1990 and 1996 had average annual productivity growth rates 4.9 percentage points higher when measured by labour productivity and 0.6 percentage points higher when measured by MFP than for non-entrants. The difference between labour productivity and MFP growth suggests that plants that begin to export increase their capital accumulation relative to non-entrants—which suggests that the very act of preparing to enter export markets can transform firm-level production processes. They note that exporters in general were the dominant source of aggregate productivity growth—accounting for more than 75% of aggregate productivity growth in manufacturing in the 1990s.

2. Plant-level productivity is derived by deflating plant-level nominal output with the available industry-level deflators. This is imperfect, but the best that can be done when no firm-specific deflators are available. Using a special Danish manufacturing panel data, Smeets and Warzynski (2013) show that international trade premiums are significantly larger when output is deflated with their firm-specific price index rather than the traditional industry-level price index.

Table 1
Average labour productivity of plants with different export-market transitions in the 1990-to-1996 period

	1990	1996	Growth per year
	number	number	percent
Non-exporters	56.5	54.0	-0.7
Entrants to export markets	71.6	89.2	3.7
Exiters from export markets	87.2	72.7	-3.0
Continuing exporters	100.0	117.4	2.7

Note: Average labour productivity is calculated as an unweighted average across plants. It is set to 100 for continuing exporters in 1990.

Source: J.R. Baldwin and W. Gu, 2003, "Export-market participation and productivity performance in Canadian manufacturing," *Canadian Journal of Economics* 36 (3): 635–657, Table 4.

Baldwin and Yan (2014) extend earlier work and demonstrate that the productivity benefits for Canadian manufacturers of starting to export, extend to global value chain (GVC) starters (firms that start exporting and importing), and that productivity losses occurred for the GVC stoppers.

Besides the positive link to exporting, productivity growth could also benefit from productivity gains abroad through imported intermediate inputs. Industries depend on accessing imports of goods and services to improve their productivity. A recent paper by Gu and Yan (2014) shows that a significant part of Canada's effective multifactor productivity (EMFP)[3] growth originates from productivity gains in the production of intermediate inputs in foreign countries (Table 2). For example, between 1995 and 2000, 25% of MFP growth in Canada came from productivity growth in foreign countries (among which 22% was from the United States). The overall foreign contribution to Canada's MFP increased to 67% (among which 50% was from the United States) during the period from 2000 to 2007. This is because Canada imported a large share of intermediate inputs (23%) compared with other countries (10%), and productivity growth in the foreign-supplier industries (notably the United States) increased between the two periods. Canada's foreign productivity gains were particularly pronounced in machinery and equipment and export products.

3. The standard MFP growth measures the efficiency with which industries use inputs in their production. It does not capture the impact that productivity gains in upstream industries have on productivity gains in downstream industries. It is constructed as the growth in gross output that is not accounted for by the growth in capital, labour and intermediate inputs in the industry. In contrast to the standard MFP growth, the EMFP growth captures the impact of upstream industries. It is constructed as the difference in the growth in gross output that is not accounted for by the growth in total capital and labour inputs used directly in the final industry sector and indirectly in the upstream industries supplying intermediate inputs both domestically and from abroad.

Table 2
Country origins of effective multifactor productivity (EMFP) growth for Canada, by type of product, 1995 to 2000 and 2000 to 2007

Type of product and country	1995 to 2000		2000 to 2007	
	EMFP Growth	Relative contribution	EMFP Growth	Relative contribution
	percentage points	percent	percentage points	percent
Total, final demand product	0.86	100	0.23	100
Canada	0.65	75	0.08	33
United States	0.19	22	0.12	50
Other foreign countries	0.03	3	0.04	17
Total, consumption products	0.53	100	0.20	100
Canada	0.39	74	0.09	45
United States	0.12	23	0.09	45
Other foreign countries	0.02	4	0.02	10
Total, investment products	1.94	100	0.33	100
Canada	1.47	76	0.05	15
United States	0.41	21	0.22	65
Other foreign countries	0.06	3	0.07	21
Total, export products	1.68	100	-0.16	100
Canada	1.31	78	-0.42	247
United States	0.33	20	0.20	-118
Other foreign countries	0.04	2	0.05	-29

Source: W. Gu and B. Yan, 2014, *Productivity Growth and International Competitiveness*, The Canadian Productivity Review, no. 37, Statistics Canada Catalogue no. 15-206-X, Ottawa: Statistics Canada.

Trade policies that facilitate foreign market access have a large impact on labour productivity gains (Trefler 2004; Lileeva and Trefler 2010). Trefler (2004) estimates that Canadian tariff concessions under the Canada–United States Free Trade Agreement (CUSFTA) raised labour productivity by a compound annual growth rate of 1.9% for the most impacted, import-competing group of industries (such as the brewery products industry, and the shipbuilding and repair industry) with at least half of this coming from the exit and/or contraction of low-productivity plants. For the most impacted, export-oriented group of industries (such as the sweater industry and the women's blouse and shirt industry), labour productivity at the plant level rose by 1.9% annually as a result of U.S. tariff concessions.[4] Trefler (2004), Lileeva and Trefler (2010) and Melitz and Trefler (2012) estimated that CUSFTA raised overall Canadian manufacturing productivity by 13.8% over the period from 1988 to 1996.

While trade is associated with faster productivity growth, the magnitude of the gain associated with trade liberalization is also affected by exchange rate movements (Baldwin and Yan 2012a). Depreciation of the Canadian dollar relative to the American dollar—similar to raising home tariffs and lowering foreign tariffs—increases export sales by making Canadian exports cheaper in the United States (while increasing the cost of imports). Conversely, appreciation of the Canadian dollar reduces exports by making Canadian exports more expensive (while it decreases the cost of imports). Baldwin and Yan (2012a) show that the superior performance of Canadian export starters was reinforced in the 1990-to-1996 period by the depreciation experienced by the Canadian dollar at the time. In contrast, the benefits normally accompanying new exporters disappeared in the 1984-to-1990 and 2000-to-2006 periods when the Canadian dollar appreciated. In particular, the dramatic increase in the value of the Canadian dollar during the post-2000 period was accompanied by almost no gains in productivity by new export-market participants (Table 3).

4. For a complete list of the most-impacted industries, see Trefler (2004), Table A1.

Table 3
Contribution to productivity growth gaps, a counter-factual exercise

	1984 to 1990	1990 to 1996	2000 to 2006
	percentage points		
Average annual changes in average tariffs between Canada and United States	-0.3	-0.6	0.0
Average annual changes in real exchange rates	1.6	-1.9	5.5
Actual average annual mean differences in labour productivity growth, entrants less continuing non-exporters	2.0	5.3	0.1
Estimated differences	2.9	5.2	0.3
Should there be no changes in tariffs and real exchange rates	4.1	4.1	4.1
Due to changes in tariff rate	-0.1	-0.2	0.0
Due to changes in real exchange rate	-1.1	1.3	-3.8
Actual average annual mean differences in labour productivity growth, exiters less continuing exporters	-3.1	-6.9	-0.2
Estimated differences	-4.7	-6.6	-2.7
Should there be no changes in tariffs and real exchange rates	-5.7	-5.7	-5.7
Due to changes in tariff rate	0.1	0.2	0.0
Due to changes in real exchange rate	0.9	-1.0	3.0

Source: J.R. Baldwin and B. Yan, 2012, "Export market dynamics and plant-level productivity: Impact of tariff reductions and exchange-rate cycles," *Scandinavian Journal of Economics* 114 (3): 831–855.

These studies indicate that access to foreign markets—brought about either by tariff cuts or currency depreciation—boosts productivity. More generally, entry to new markets (whether domestic or foreign) is associated with improved productivity. Baldwin and Yan (2012b) find that domestic firms that expand across provincial borders enjoy an increase in productivity and perform as well as those that expand across international borders. Moreover, exits from export markets are not necessarily associated with deteriorating performance—exits can increase productivity when new domestic markets are entered. During the post-2000 period that is characterized by new resource-led opportunities in expanding domestic markets, plants that exited export markets and began to serve new domestic markets performed much better, contributing to 53% of aggregate labour productivity growth in the Canadian manufacturing sector between 2000 and 2006 (Baldwin, Gu and Yan 2013).

3 Uncovering the mechanisms of trade-induced productivity growth

The previous section established that firms that adapt and find new markets generally have superior productivity performance. What exactly drives these productivity improvements? To gain a better understanding of the link between changes in trading opportunities and productivity, a set of papers examined the 'between-firm' and 'within-firm' sources of trade-induced productivity gains.

3.1 Firm dynamics and the reallocation effect

Trade models with heterogeneous firms (Melitz 2003; Melitz and Ottaviano 2008; Bernard et al. 2003) analyze the range of potential responses of individual firms to trade liberalization—this literature generally shows that tariff reductions lead the least productive firms to exit and the

more productive ones to expand. In this process, economic resources shift from less-efficient to more-efficient firms, thereby raising aggregate productivity.[5]

Exporters differ from non-exporters in ways that are consistent with the self-selection process underlying these heterogeneous firm-trade models. It is generally the larger and more productive firms that become exporters and export more: on average, over the period from 1974 to 2010, only 35% of Canadian manufacturing firms were exporters, but they contributed more than 70% of total manufacturing employment and shipment, and they were 13% more productive than non-exporters (Table 4).[6] In addition, export intensity (the ratio of exports to total shipment) generally increases with firm size: an average of 33% of total output is exported for small firms, compared to 37% for medium-sized firms and 43% for large firms (Table 5).

Table 4
Summary statistics of exporters

Period	Exporters' share in			Labour productivity, exporters relative to non-exporters
	Number of firms	Employment	Shipments	
		percent		ratio
1974 to 1979	24	60	68	1.02
1979 to 1984	24	61	70	1.00
1984 to 1990	29	64	74	1.44
1990 to 1996	34	68	81	1.63
1996 to 2000	35	72	84	1.31
2000 to 2005	39	77	82	1.10
2005 to 2010	39	75	79	0.86
1974 to 2010	35	72	79	1.13

Note: To correct for changes in the sample frame and firm classification after 2000 and make results consistent over time, the authors have excluded firms with less than 10 employees. In calculating exporters' share of total employment, the authors have also made adjustments to post-2000 data to reflect changes in the population covered by the Annual Survey of Manufactures that occurred in 2000.
Source: Statistics Canada, authors' calculation based on data from the Annual Survey of Manufactures.

5. See Lapham (forthcoming) for an accessible overview of recent firm-based models of international trade.
6. In the 2005-to-2010 period, the labour productivity of exporters was actually lower (86% of non-exporters). This is due to the dramatic increase in the value of the Canadian dollar during the post-2000 period that almost completely offset the advantages enjoyed by export-market participants (Baldwin and Yan 2012a).

Table 5
Export intensity (share of exports value in total shipments) by firm size

Period	All exporters	Small, more than 10 but less than 100	Medium, 100 to 250	Large, more than 250
		percent		
1974 to 1979	27.8	23.6	24.7	28.5
1979 to 1984	31.7	28.3	27.1	32.6
1984 to 1990	36.2	29.1	26.5	38.6
1990 to 1996	42.0	29.6	33.1	45.3
1996 to 2000	46.1	32.4	38.3	49.3
2000 to 2005	45.2	35.9	41.4	47.7
2005 to 2010	41.2	37.4	41.4	42.0
All period	41.4	33.1	37.0	43.4

Note: To correct for changes in the sample frame and firm classification after 2000 and make results consistent over time, the authors have excluded firms with less than 10 employees. In calculating exporters' share of total employment, the authors have also made adjustments to post-2000 data to reflect changes in the population covered by the Annual Survey of Manufactures that occurred in 2000.
Source: Statistics Canada, authors' calculations based on data from the Annual Survey of Manufactures.

Several studies find empirical support for the reallocation effect as a source of productivity benefits from trade liberalization. As trade barriers fall, more productive non-exporters expand to export markets, and the more productive exporters increase their foreign sales. Baldwin and Gu (2004b) show that the reallocation of output across plants is responsible for more than half of productivity growth for 13 of the 22 manufacturing industries over the 1988-to-1997 period. For a few industries, such as clothing and textile products that experience deep tariff cuts under the North American Free Trade Agreement (NAFTA), 90% to 100% of productivity growth is due to the reallocation of output towards more productive plants. For the manufacturing sector as a whole, changes in market share account for over one-half (53%) of the overall productivity growth.

Trefler (2004), Lileeva and Trefler (2010) and Melitz and Trefler (2012) estimated that CUSFTA raised overall Canadian manufacturing productivity by 13.8% over the 1988-to-1996 period. The predominant mechanism through which CUSFTA increased Canadian manufacturing productivity is the reallocation effect, accounting for 61% of the productivity gain (Table 6).

Table 6
Mechanisms through which the Canada–United States Free Trade Agreement increased Canadian manufacturing productivity

	Growth impact	Relative contribution
	percent	
Between plants (selection and reallocation)	8.4	61
Growth of exporters (U.S. tariff cuts)	4.1	30
Contraction and exit of least-productive plants (Canadian tariff cuts)	4.3	31
Within plants	5.4	39
New exporters invest in raising productivity	3.5	25
Existing exporters invest in raising productivity	1.4	10
Improved access to U.S. intermediate inputs	0.5	4
Total	13.8	100

Source: M.J. Melitz and D. Trefler, 2012, "Gains from trade when firms matter," *Journal of Economic Perspectives* 26 (2): 91–118.

3.2 Specialization and scale effect

Perhaps the most obvious link between market access and productivity is the potential to exploit economies of large-scale production with larger markets. High trade barriers and limited market size may lead to shorter production runs, arising either from sub-optimal plant size or excessive product-line diversity. Trade liberalization and access to larger American markets offer Canadian firms the possibility to increase firm size, plant scale or product specialization, which in turn leads to lower average production cost and higher productivity.

Several studies investigate whether trade promotes efficiency through increased scale. Head and Ries (1999) find American tariff cuts under CUSFTA generated a 9.8% increase in output per plant that is mostly offset by an 8.5% contraction caused by the Canadian tariff reduction. Studies by Baldwin, Beckstead and Caves (2002), Baldwin, Caves and Gu (2005) and Baldwin and Gu (2006) provide evidence that the primary influence of CUSFTA was on production-run length through increased plant specialization. Indeed, there was a dramatic increase in plant specialization in Canadian manufacturing following CUSFTA. Plants specialized in fewer commodities over both the 1980s and 1990s, but the pace of commodity specialization increased substantially around the time of CUSFTA implementation. The dramatic reduction in product diversity was accompanied by a substantial increase in the length of production runs of manufacturing plants.

3.3 Learning-by-doing effect

Trade liberalization has also been posited to affect productivity through learning spillovers. Endogenous growth theory focuses on the possibility of external effects such as investment in tangible assets, human capital or research and development (R&D) by one firm that spills over and increases the stock of knowledge available to all firms (Arrow 1962; Romer 1986; Lucas 1988). Analysts have argued that trade facilitates the transfer of knowledge and ideas across countries (Grossman and Helpman 1991; Coe and Helpman 1995). This is accomplished through the transfer of knowledge to firms that move into international markets and interact with a new set of partners they encounter when they go abroad.

Baldwin and Gu (2003, 2004a) present four pieces of evidence that trade liberalization fosters learning for Canadian exporters. First, productivity gains from entry to export markets are greater for domestic-controlled plants and for young plants. This is consistent with the learning model since both younger plants and domestic plants are more likely to benefit from information gained as a result of exposure to foreign markets because their information acquisition systems are less-developed than older or foreign-owned plants. This 'advantage of backwardness' (Gerschenkron 1962) suggests that a part of the efficiency gain from trade is through learning by exporting.

Second, exporting is linked to an increased use of foreign technology at plants. The number of advanced technologies adopted is larger in new exporters than in non-exporters following CUSFTA, whereas prior to export entry there is no difference. New exporters are 37% more likely to use foreign technologies than non-exporters, while the probability of using foreign technologies is similar between exporters and non-exporters prior to entry to the export market.

Third, exporting is associated with an increased incidence of R&D collaboration agreements with foreign buyers. R&D is central to endogenous growth models and at the heart of the innovation process. Exporting is associated with firms that are more likely to produce world-first innovations.

Fourth, exporting improves the flow of information about foreign technologies to Canadian plants. Exporters are much less likely to view the lack of information on foreign technologies as

a significant impediment to their use, while, prior to entry to the export market, these plants are as likely as non-exporters to view the lack of information as a significant impediment.

3.4 Innovation and technology adoption

Endogenous growth theory identifies innovation in the form of new and improved products, processes and markets as a key driver of technological progress and productivity. It argues that intellectual capital—the source of technological progress—grows through innovation (Romer 1990; Grossman and Helpman 1991; Aghion and Howitt 1992).

Access to larger markets increases incentives to innovate. Innovation requires fixed costs. The larger the market, the more profitable it is for firms to invest in innovation. Trade liberalization, by expanding the size of the market, encourages firms to export and simultaneously invest and innovate, which in turn raises firm-level productivity growth. The complementarity between exporting and innovation is explored in theoretical models by Grossman and Helpman (1991), Yeaple (2005), Costantini and Melitz (2007), and Lileeva and Trefler (2010).

Theories of innovation-based gains from trade are supported by Canadian evidence (Baldwin and Gu 2004a; Lileeva and Trefler 2010). As noted above, Baldwin and Gu (2004a) find that exporting is linked to an increase in the intensity of technology use. In addition, innovative capabilities are enhanced as new exporters invest in R&D and training to develop the absorptive capacity required to ingest foreign ideas and technologies. The likelihood that R&D is performed on an ongoing basis is 10 percentage points higher in exporters than in non-exporters—there is no such difference before plants enter the export market. Larger plants that become exporters also increase their emphasis on training as a general strategy.

Lileeva and Trefler (2010) report that new exporters who experience labour productivity gains are those who engage in product innovation and adopt advanced technologies. In the period immediately after implementation of CUSFTA (between 1989 and 1993), the group of new exporters that experienced labour productivity gains are those that adopted advanced technologies and engaged in product innovation more frequently than non-exporters. In contrast, the difference in technology adoption and product innovation disappears when comparing non-exporters and the group of new exporters that do not experience labour productivity gains.

3.5 Competition

Trade may also induce changes in efficiency arising from a different competitive environment that firms face in export markets. Penetrating external markets may increase the need to respond to nimble opponents. In a world where a lack of competition engenders complacency and results in high levels of x-inefficiency (the productivity of firms relative to the production frontier), trade liberalization has the beneficial effect of increasing competitive pressures.

Baldwin and Gu (2004a) provide evidence that penetration into foreign markets changed the competitive threats faced by Canadian firms. Non-exporters did not rank competition from abroad as very meaningful. Exporters indicated that they face much more significant competition from abroad after entering foreign markets than non-exporters.

3.6 Capacity utilization

Not all increases in foreign penetration are necessarily productivity-enhancing. Increased foreign market access can also affect productivity through changes in the use of production capacity. Costs associated with adjusting production inputs to foreign markets that might be more volatile than domestic markets can lead to over-capacity or under-use of production

facilities and changes in productivity. On the one hand, access to a foreign market whose demand differs from that of the domestic market offers diversification benefits from smoothing demand fluctuations and potential savings in capital. On the other hand, unanticipated fluctuations in exchange rates may offset the advantages of serving large export markets and lead to extensive periods of overcapacity and reduced productivity.

Recent studies suggest that the Canadian manufacturing sector experienced significant adjustment costs due to a rapid and large appreciation of the Canadian dollar vis-à-vis its American counterpart after 2000. The dramatic decline in manufacturing labour productivity post 2000 was caused by overcapacity in Canadian plants serving the American export market that developed during this period. Aggregate labour productivity growth in manufacturing declined from 3.7% per year during the 1990-to-1999 period to 1.7% per year in the 2000-to-2006 period. At the same time, exporting opportunities also declined sharply between the two periods, due partly to the dramatic appreciation of the Canadian dollar relative to its American counterpart, among other factors. Baldwin, Gu and Yan (2013) use a decomposition method to trace the sources of the decline of productivity growth and find that excess capacity that developed at this time was the primary cause behind the productivity growth slowdown post 2000. The deceleration in labour productivity growth was almost entirely driven by significant under-utilization of production capacity among continuing exporters arising from lower demand in export markets. This accounted for 80% or 1.6 percentage points of the 2.0-percentage-point total decline in productivity growth in the sector.

4 Conclusion

A common theme emerging from this empirical research is that adapting to new larger markets matters for productivity growth. Macroeconomists typically model a static production function (relating inputs—such as capital and labour—to final output). The body of research summarized in this paper that exploits rich firm-level data reveals that demand shocks such as those brought about by trade liberalization and exchange-rate movement can change the firm-level production function, both in terms of preparing for and adapting to the shocks. New larger markets, whether they are domestic or foreign, are beneficial to productivity growth, but successful expansion to new markets also depends on firms' abilities to adapt, invest and innovate.

Larger markets raise productivity by allowing firms to exploit economies of plant scale and/or product specialization, by forcing firms to become more efficient in the face of more competitive pressure, and by offering firms more incentives and possibilities to innovate and invest. Access to foreign markets provides the additional benefit of improved information flows and learning from foreign buyers that together allow exporters to benefit from the adoption of foreign technologies. The benefits from access to larger markets are not automatic—plants that succeed need to invest in advanced technologies, R&D and training to develop the absorptive capacity for learning from international best practices.

The size of these benefits may be attenuated by other changes in international markets—changes brought about by exchange-rate movements that change the competitiveness of exporters. Indeed, recent evidence highlights the challenges facing the Canadian manufacturing sector, which made heavy investments in the 1990s to serve the new American markets that were opened up by CUSFTA and NAFTA, only to face a decline in opportunities in this market a decade later.

To gain a better understanding of the impacts of trade on firm dynamics and productivity, more research is needed on the differences in adjustments post 2000 by Canadian manufacturers, on whether there were substantial differences between the adjustments of domestically owned and

foreign-controlled firms, on how the entry and exit to export markets responded to changes in competitiveness, and on how the Canadian innovation regime reacted to these changes.

More research is also needed to gain a better understanding of the impacts of free trade in other economic dimensions such as the short-run and long-run adjustment costs in the labour market. Compared to research on the long-run productivity benefits of free trade, Canadian studies that examine the impacts of free trade on worker displacement, earnings and income inequality are scarce, with the exception of Gaston and Trefler (1997), Beaulieu (2000) and Trefler (2004), Breau and Brown (2011).

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